UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

SINGULAR COMPUTING LLC,	Civil Action No. 1:19-cv-12551 FDS
Plaintiff,	
v.	Hon. F. Dennis Saylor IV
GOOGLE LLC,	
Defendant.	

DEFENDANT GOOGLE LLC'S SUPPLEMENTAL CLAIM CONSTRUCTION BRIEF

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I.   INTRODUCTION

Pursuant to the Court's authorization of supplemental claim construction briefs (ECF No. 139), Google respectfully submits this brief to address the deposition of Singular's expert, Dr. Sunil Khatri. Only Dr. Khatri's deposition is pertinent; Singular chose not to depose Google's expert, Dr. Gu-Yeon Wei.

Dr. Khatri's deposition confirms two things. ***First***, the asserted claims are indefinite because one of skill in the art cannot determine the boundaries of the phrase "repeated execution." Dr. Khatri's testimony confirms the absence of any dispute as to any of the factual premises of Google's indefiniteness argument. And his proposed interpretation lacks any support in the intrinsic evidence and is indefinite in its own right.

Second, Google's proposed construction of "first input signal representing a first numerical value" as "a digital and/or analog representation of a value that the LPHDR execution unit operates on" is correct. Dr. Khatri's testimony acknowledges that the claimed LPHDR execution units operate on the numerical values represented by the input signals. Accordingly, the Court should adopt Google's proposed construction.

II.   ARGUMENT

A.   Dr. Khatri's testimony confirms that "repeated execution" is indefinite and the absence of any dispute material to indefiniteness.

The asserted claims are indefinite because a skilled artisan cannot objectively determine how many "repeated executions" of operations are needed to determine whether a device infringes. *See generally* Google Preliminary Br. (ECF No. 111) at 6-11; Google Reply Br. (ECF No. 134) at 2-5. And while Dr. Khatri disputes Google's bottom-line conclusion of indefiniteness, his testimony shows that every point asserted in Google's argument is undisputed—if only because Dr. Khatri declined to articulate any contrary opinion:

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Google Argument	Khatri Testimony
The phrase "repeated execution" supplies the claimed test for measuring whether the LPHDR execution units' operation is sufficiently different from exact mathematical calculations to satisfy the asserted patents' claimed minimum percentage of inaccuracy. *E.g.*, '273 patent at 30:6-15.	"[T]he term 'repeated execution' . . . is readily understandable by a person of ordinary skill in the art ('POSITA') when read in the context of the conjoining claim language, and is explicitly tied to finding 'the statistical mean' of the numerical values of the output." Khatri Decl. (ECF No. 135-1), ¶ 27.
The phrase "repeated execution" is not meaningful in the context of conventional digital embodiments, which are deterministic. Wei Decl. (ECF No. 114), ¶¶ 23-24, 35.	*See* Declaration of Jay Rapaport ("Rapaport Decl."), Ex. A ("Khatri Depo.") at 29:4-32:5 (declining to respond to Dr. Wei's opinion that "repeated execution" is not meaningful as to conventional digital embodiments).
The asserted patents include analog embodiments. *E.g.*, '273 patent at 11:32-39, 14:16-26.	"[W]hether or not Claim 53 is applicable to analog -- you know, analog embodiments is not something I've studied directly for this -- for the purpose of writing this declaration." Khatri Depo. at 30:24-31:2; *see also id.* at 38:5-22.
Because analog signals are vulnerable to noise, analog systems cannot generate repeatable results when executing a given operation on a particular input. *E.g.*, Wei Decl., ¶¶ 25-27; '273 patent at 4:12-13.	"As the Singular patent specification explains, devices that use analog signals to represent numbers 'introduce noise into their computations'. *See* '273 patent at 4:12-13. Performing the same operation twice with identical inputs will statistically produce different output values . . . ." Khatri Decl., ¶ 33. "So what line 2 [of paragraph 33 of the Khatri declaration] means is that when you perform the same operation twice -- so if you apply the same exact inputs, right, then there is statistical variation in the output values. So that's -- you know, based on that initially, we -- the arithmetic average would be varying, it would fluctuate, is what this line explains." Khatri Depo. at 52:10-16.
As a result, different numbers of executions of an operation will yield inconsistent results and, by extension, a constantly changing statistical mean of all results that can drift in	"Performing the same operation twice will statistically produce different output values, and initially, a fluctuating arithmetic average." Khatri Decl., ¶ 33 (emphasis omitted).

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and out of the claimed degree of inaccuracy. Wei Decl., ¶¶ 38-43.	"At first, near the left side of the graph, the arithmetic average of the output value is unstable and fluctuates significantly over short periods of time (as shown by the magnified portion of the graph outlined using the red box)." Khatri Decl., ¶ 34.
The claims, specification, and prosecution history provide no guidance on how many repeated executions are required. Wei Decl., ¶¶ 44-48.	*See generally* Khatri Decl., ¶¶ 27-36 (citing no intrinsic evidence on number of required executions).

Thus, although Singular insists that the "factual premises" underlying Google's indefiniteness argument are in dispute, Singular Reply Br. (ECF No. 135) at 9, Singular cannot point to any material dispute with any of the points Google has made. Rather than taking those points to their logical conclusion—that one of skill in the art cannot know how many repeated executions the asserted claims require—Dr. Khatri insists that the problem of unpredictable results will eventually work itself out because a skilled artisan "would know" that repeated execution "require[s] . . . conduct[ing] a large enough number of repetitions until the statistical mean reached its stable value." Khatri Decl., ¶ 28. In other words, when faced with the question of "How many executions do the asserted claims require?", Dr. Khatri's answer is "as many as are needed."

That circular response is no answer to the problem of indefiniteness. To start, Dr. Khatri's argument is not just *ipse dixit*, but multiple levels of *ipse dixit*. According to Dr. Khatri, a skilled artisan would know what to do because of the statistical concept of the "Law of Large Numbers"; that executing an operation a large number of times will eventually yield a "population mean," which is "necessarily stable"; and that if a large number of repeated executions fails to yield a stable statistical mean (which is possible), the "repeated execution" limitation will never be met because the "device would simply not serve a useful purpose as an execution unit." Khatri Depo. at 99:7-100:4, 64:20, 92:2-93:21; *see also* Khatri Decl., ¶¶ 26-29, 36.

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Equally problematic, Dr. Khatri creates a new indefiniteness problem by incorporating various subjective terms of degree into his explanation of how a person of skill in the art would understand "repeated execution." Specifically, he defines a "stable" statistical mean as an average that "never ***materially*** changes again," does not "***meaningfully*** fluctuate," or has ceased to "fluctuate[] ***significantly***." Khatri Decl., ¶¶ 29, 33, 34 (emphasis altered). But "[w]hile beauty is in the eye of the beholder, a claim term, to be definite, requires an objective anchor"—an anchor that Dr. Khatri has failed to provide. *Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1350 (Fed. Cir. 2005), *abrogated on other grounds by Nautilus Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 912 n.9 (2014). To the contrary, Dr. Khatri testified that what constitutes a "stable" statistical mean is context-dependent:

> Q.: Is there any objective measure that one of skill in the art could apply to determine whether they had an unstable value based on [too] few executions versus a stable statistical mean based on sufficient executions?
>
> . . . .
>
> THE WITNESS: The answer is that there is no single size answer to that. It depends on the circuit. It depends on the technology in which the circuit was implemented. It depends on the nature of the application. Depends on the statistics of the output signal. And all of this, someone who is working on that circuit, a person of ordinary skill in the art, once they have all this context, it would be quite clear to them as to when they're -- when they're seeing a stable value and when the value is still fluctuating. So this is something that cannot be answered universally as you wish me to do because it wouldn't be -- it wouldn't be accurate for me to answer that question universally.

Khatri Depo. at 110:19-111:24.

Repeatedly, Dr. Khatri testified that a skilled artisan's understanding of a "stable" statistical mean would depend not just on the nature of the circuit, but also the circuit's "context" and "application," and thus could say only that a skilled artisan would simply know when a sufficiently stable statistical mean had been reached. *Id.* at 109:23-110:9 ("[A] person of ordinary skill in the art would know for their circuit when that happens."); 112:8-14 ("[T]he person of skill in the art, since they're intimately familiar with the circuit and the application and the technology, they would know when that value has reached a stable -- when the -- you know,

when that stable statistical mean that does not meaningfully fluctuate has been accomplished or has been reached."); 113:4-9 ("The meaningfulness, as I've said more than once before, is known to the person of ordinary skill in the art who is designing the circuit. They know for that application what meaningful is. And that's something that is known to the person."). Even Dr. Khatri's testimony on re-direct confirmed his inability to provide objective standards for determining a stable statistical mean following "repeated executions" of the operations described in the claims. *Id.* at 142:6-24, 150:18-152:18.

Dr. Khatri's claim that persons of ordinary skill in the art would know a meaningfully stable statistical mean when they see it is remarkable given that the asserted patents' inventor, Dr. Joseph Bates, publicly admitted that he could not get an analog version of his invention to work. Rapaport Decl., Ex. B at 5:12-13. In any event, where, as here, a patent owner points to terms of degree that invite subjective judgments ("materially," "meaningfully," "significantly"), the Court "must look to the written description for guidance." *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1371 (Fed. Cir. 2014). And because Dr. Khatri cites no intrinsic evidence supporting his opinion, his "facially subjective" interpretation of the claim language leaves the asserted claims "without an objective boundary." *Id.* at 1373. Dr. Khatri's declaration does not rely on the specification or prosecution history to bolster his opinion, even though they are "the most important evidence when addressing indefiniteness." *KLA-Tencor Corp. v. Xitronix Corp.*, No. A-08-CA-723-SS, 2011 WL 318123, at *2 (W.D. Tex. Jan. 31, 2011); *see generally* Khatri Decl., ¶¶ 27-36. Nor did Dr. Khatri point to any intrinsic evidence at deposition. Khatri Depo. at 97:6-98:8.

Simply put, Dr. Khatri's entire opinion rests on "conclusory, unsupported assertions," which "are not useful" for claim construction. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1318 (Fed. Cir. 2005). Because "an expert cannot offer an opinion on claim construction based solely on his experience, '[u]ntethered to any supporting evidence,'" the Court should reject Singular's attempt to manufacture a factual dispute and find the asserted claims indefinite. *Midwest Athletics & Sports All. LLC v. Ricoh USA, Inc.*, No. 2:19-CV-00514-JDW, 2020 WL 6158233, at

*11 (E.D. Pa. Oct. 21, 2020) (quoting *TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1362 (Fed Cir. 2019)).

> **B.   Dr. Khatri's testimony and Singular's preliminary IPR responses support Google's proposed construction of "first input signal representing a first numerical value."**

Google has proposed construing "first input signal representing a first numerical value" as "a digital and/or analog representation of a value that the LPHDR execution unit operates on." Singular opposed that construction by arguing that it "impermissibly attempts to rewrite the asserted claims so that the claimed execution unit operates on numerical values, and not on 'input signals' that represent numerical values." Singular Preliminary Br. (ECF No. 112) at 17, *see also* Singular Reply Br. (ECF No. 135) at 17. But Singular's preliminary responses to Google's petitions for IPR of the asserted patents, declarations submitted by Dr. Khatri supporting those responses, and his deposition testimony all directly contradict that contention.[1]

In three of its preliminary IPR responses, Singular acknowledges that "whether the numbers are physically represented using charges, voltages, various forms of spikes, or other forms, or a combination of digital and analog representations . . . *the invention* . . . *operates on the values represented, not their physical representation*." Rapaport Decl., Ex. C (Patent Owner's Preliminary Response, IPR 2021-00178) at 52 (emphasis added). Dr. Khatri has made similar admissions. In his declarations supporting Singular's preliminary responses to Google's IPR petitions, he attested that the claimed "invention . . . is about performing LPHDR arithmetic on the numbers represented by . . . voltages, etc." Rapaport Decl., Ex. D (Declaration of Sunil P Khatri, IPR 2021-00178), ¶ 58. And he subsequently reaffirmed that statement in his deposition. Khatri Depo at 131:18-19 ("I stand by it.").

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[1] For simplicity's sake, Google has only attached a copy of excerpts from Singular's preliminary response to one of the IPR petitions for the '273 patent and Dr. Khatri's declaration supporting that response. However, any statements from that response or Dr. Khatri's supporting declaration that Google references in this brief also appear in Singular's preliminary responses to IPR petitions directed to the two remaining asserted patents and Dr. Khatri's declarations supporting those responses.

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Notably, these are far from the only times Dr. Khatri's testimony is in tension with

Singular's claim construction positions. At best, Dr. Khatri's testimony is entirely irrelevant to

Singular's claim construction arguments, even when submitted in support of those arguments. At

worst, his testimony actively undermines Singular's arguments. For example, and as Google has

explained in its prior briefing, one of the virtues of its proposed construction of "first input signal

representing a first numerical value" is that it clarifies that the antecedent basis for the claim

language's subsequent reference to "the possible valid inputs" to the LPHDR execution unit's

operation is "a numerical value," and not "a first input signal." Google Preliminary Br. (ECF No.

111) at 19-20; Google Reply Br. (ECF No. 134) at 11-12. Any interpretation whereby the

antecedent basis for "the possible valid inputs" is an "input signal" is impossible to square with

the claim language's requirement that "the possible valid inputs" have a specific dynamic range

of ***values*** (e.g., from 1/1,000,000 to 1,000,000).[2] Google Preliminary Br. (ECF No. 111) at 19-

20; Google Reply Br. (ECF No. 134) at 11-12.

Singular attempts to sidestep this problem by relying on a declaration submitted by

Dr. Khatri wherein he attests that signals "***can*** . . . have a dynamic range." Khatri Decl., ¶ 37

(emphasis added). But that testimony fails to address the pertinent issue. Google agrees that

signals themselves can have dynamic ranges. But that has no bearing on whether the claim

language regarding the dynamic range of the LPHDR execution unit refers to the "first input

signal" instead of its representation of "a first numerical value." As a result, Dr. Khatri's

testimony is irrelevant to the parties' dispute. Notably, Dr. Khatri himself agrees. During his

deposition, he repeatedly emphasized that his testimony has nothing to do with the asserted claim

language, going so far as to say that it would be "misleading and incorrect . . . to say that . . . [he

was] saying something about some claim in the patent." Khatri Depo at 124:15-17; *see also id.* at

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[2] It would also be inconsistent with the allegations in Singular's own complaint. *See, e.g.*, First
Am. Compl. (ECF No. 37), ¶ 33 ("The LPHDR execution unit . . . is configured to . . . receive as
an input to an operation an electrical signal representing numbers having a dynamic range at
least as wide as from 1/1,000,000 through 1,000,000 . . . ."); *id.*, ¶ 34 ("The new LPHDR unit of
claim 53 receives as an input an electrical signal representing numbers having a dynamic range
at least as wide as from 1/1,000,000 through 1,000,000.").

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125:20-22 ("And specifically paragraph 37 refutes—doesn't have anything to do with Claim 53 or it doesn't have any mention of Claim 53 in it.").[3]

As the above discussion shows, Singular's own preliminary IPR responses and the testimony of its own expert all acknowledge that Google's construction is correct. And because "[s]tatements made during IPR proceedings, including in preliminary responses filed prior to board proceedings . . . are relevant to claim construction," those acknowledgements support adopting Google's proposed construction. *Aylus Networks, Inc. v. Apple Inc.*, 856 F.3d 1353, 1361 (Fed. Cir. 2017); *see also Bio-Rad Labs., Inc. v. 10X Genomics, Inc.*, No. 19-CV-11533-WGY, 2020 WL 6263697, at *13 (D. Mass. Oct. 23, 2020).

III.   CONCLUSION

For the foregoing reasons and those set forth in Google's preliminary and reply briefs, the Court should find the phrase "repeated execution" indefinite—thereby obviating the need for further proceedings—or adopt Google's construction of the phrase "first input signal."

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[3] Dr. Khatri's hesitance to opine on this portion of the claim language is understandable because Singular's suggestion that the claim language's reference to the "dynamic range of the possible valid inputs" concerns the dynamic range of input signals, and not numerical values, directly contradicts Dr. Khatri's testimony in the related IPR proceedings. *See* Singular Reply Br. at 14. Indeed, in declarations he submitted to the PTAB, Dr. Khatri acknowledged that this language concerned the dynamic range of the numerical values represented by first input signals, not the dynamic range of the signals themselves. Rapaport Decl., Ex. D (Declaration of Sunil P Khatri, IPR 2021-00178), ¶ 46 ("As explained in the '201 Application, the width of the integer portion determines the dynamic range of the value of the number represented . . . . In the example given, 5 bits in the integer portion provides a dynamic range from one billionth to one billion.").

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Respectfully submitted,

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